"Following a human intervention of the right kind, Nature will often take over and heal itself. What is needed is not esoteric knowledge and technologies but simply good management and social will."

René Dubos, *The Resilience of Ecosystems*, 1978

Restoration

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Once dominant in the understory of the Catoctin Mountain Park forest, the flowering dogwood was devastated by fungal disease in the 1980s and 1990s. This aesthetically and ecologically valuable tree species is being restored experimentally thanks to clones propagated from seeds and cuttings of a disease-resistant specimen discovered in the park.

If the creation of a national park, as Dr. Shirley Malcolm of the National Park System Advisory Board has said, "is a contract with the future," then restoration of park resources is reconciliation with the past. In recognition of what once was and should once again be, the National Park Service strives to restore degraded resources to health and function. Carrying out this vision involves an interesting blend of science and art. Ecological restoration integrates the professional training, technical know-how, creative talents, and judgment of ecologists, geologists, hydrologists, environmental engineers, endangered species experts, heavy equipment operators, and many other resourceful specialists. Whether working to restore dogwoods in the East, native plants in Hawaii, wetlands in the Rocky Mountains, or butterflies in the West as some of the following articles detail for 2002, the process is about hope that compromised ecosystems can be nudged toward wholeness and well-being. Results often take decades or longer to develop completely, and then—ironically—a skillful restoration may go unnoticed. Yet if the National Park Service fulfills this aspect of its contract with the future, its efforts to restore resources will not be unappreciated.

Restoring our native dogwood

by James W. Voigt

"The Catoctin dogwood project is an example of applying science to aid nature in dealing with a significant natural resource problem."

IN MAY 2002, 18 SPECIAL FLOWERING DOGWOOD trees *(Cornus florida L.)* blossomed for the first time at Catoctin Mountain Park, Maryland. What makes these trees special is their resistance to dogwood anthracnose, a lethal disease that for the last 20 years has ravaged the species at Catoctin and throughout much of the East.

Park Rangers Keith Langdon and Paul Strider first noticed diseased dogwoods at Catoctin in 1983, just four to five years after the earliest reports of a similar disease in New York and Connecticut. The disease is caused by a new species of the fungus *Disicula* (*D. destructiva* Redlin) that was first described through research funded by the National Park Service. Like many other devastating plant diseases, this causal agent is believed to be an exotic. The disease quickly progressed at Catoctin and by 1994 an NPS survey indicated that 77% of the native dogwoods had died, a significant loss. As one of the most abundant native understory species at Catoctin, flowering dogwood was of great aesthetic value and an important food source for wildlife.

In 1991 the National Park Service and the University of Tennessee began a research project to search for anthracnose resistance. Dr. Mark Windham of the Tennessee Agricultural Experiment Station collected seeds and bud wood from nine surviving trees at Catoctin. Dr. Windham propagated these trees and tested them for resistance under laboratory and field conditions. He found a high level of resistance in cuttings and seed from one particular tree, referred to as the "Presidential Tree" because of its location near Camp David. Progeny from this tree are now known as "Appalachian Spring." Several other trees were also found to be disease resistant and are being further evaluated for future planting at Catoctin.

The 18 specimens of Appalachian Spring planted at Catoctin in 2001 and 2002 are actually clones developed from the Presidential Tree by Dr. Windham. The Catoctin planting will test resistance in a natural setting. The trees were planted at four sites to evaluate differences in elevation, exposure, and canopy cover—factors that affect anthracnose development. The 3-foot-tall trees flowered beautifully in spring 2002 and appeared to be healthy throughout their first year. The park resource management staff and Dr. Windham will continue to monitor the health of these trees.

It is important to understand that Appalachian Spring and other putative disease-resistant flowering dogwoods are clones developed from selected individuals. The lack of genetic diversity in clonally propagated material is a disadvantage and a concern for the long-term restoration of a species in natural settings. One approach to overcome the lack of diversity will be to plant multiple resistant clones from other Catoctin trees in close proximity to the Appalachian Spring specimens to encourage cross-fertilization among themselves and remaining survivors in the area. The park is hopeful that this will expand disease resistance and diversity throughout the population.

The Catoctin dogwood project is an example of applying science to aid nature in dealing with a significant natural resource problem. Deliberately manipulating the genetic composition of a native species in a natural setting is controversial and should be thoroughly discussed and explored. (NPS Management Policies §4.4.1.2 deals with genetic resource management principles.) This approach, however, has potential for and relevance not only to the restoration of flowering dogwood but also to other disease-impacted species, such as the American chestnut. ■

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NPS PHOTO BY JIM VOIGT

The developer of the disease-resistant dogwood, Dr. Mark Windham, plants a specimen at the Catoctin Mountain Park Visitor Center with help from Superintendent Mel Poole. Future planting of clones developed from other disease-resistant park dogwoods may foster genetic diversity among the identical specimens.

Native plant rehabilitation in Hawaii Volcanoes National Park

by Rhonda Loh and Tim Tunison

NPS PHOTO

Students were key to the success of the restoration, collecting millions of native plant seeds.

RESTORING FIRE-DAMAGED 'OHI'A WOODLANDS in Hawaii Volcanoes National Park presents a daunting challenge to park managers. Trying to restore formerly dominant but fire-sensitive woody species like 'ohi'a *(Metrosideros polymorpha)* and pukeawe *(Styphelia tameiameiae)* is impractical given the widespread abundance of nonnative grasses and the inevitability of future wildfires. Instead, managers have adopted a rehabilitation approach to create a replacement community of fire-tolerant native plants that can survive and ideally spread in the new grass/fire cycle. This approach yielded positive results following the Broomsedge Fire, which occurred on 30 June 2000. By September 2002, visitors who walked through the burn could see signs of the revegetation effort.

Wildfires in the Hawaiian national parks are suppressed as a matter of policy because they inflict severe ecological damage. At Hawaii Volcanoes National Park, fire frequency has increased 3-fold and fire size 60-fold since the invasion and spread of broomsedge *(Andropogon virginicus)*, beardgrass *(Schizachyrium condensatum)*, and other nonnative grasses beginning in the 1960s. The most severely affected ecosystem is the seasonally dry 'ohi'a woodlands, where nearly two-thirds of the native community has been consumed by fire and replaced by nonnative savannas over the last 25 years. 'Ohi'a and pukeawe suffer high mortality in fire and individuals have difficulty reestablishing themselves after fire. In contrast, fire-adapted nonnative grasses recover vigorously and increase fine fuel loads up to three times more than in adjacent unburned areas, increasing the risk for future wildfires.

The Broomsedge Fire consumed 1,008 acres of 'ohi'a woodland and koa *(Acacia koa)* forest. Through funding provided by the interagency Burn Area Emergency Rehabilitation program, an aggressive campaign to revegetate the burn began within days of control of the fire. The goal in burned 'ohi'a woodlands is to establish fire-tolerant native plants that can survive and spread after future wildfires. Fifteen native species are identified as fire tolerant based on their ability to survive, recover, or recruit from seed after fire. Many of these species were once common to 'ohi'a woodlands but were removed by introduced feral goats that roamed the park over the last two centuries. Goats were eliminated in the mid-1970s, giving managers the opportunity to restore these important plant communities. The revegetation goal in koa forest is to establish two strips of dense native understory beneath the recovering koa trees to create vegetated fuel barriers that prevent future wildfires from spreading into nearby, biologically rich Kipuka Puaulu and across the park boundary to the Volcano Golf Course Subdivision.

More than 15,000 plants and 3,000,000 seeds of 23 native species have been restored in the burn, including thousands of mamane *(Sophora chrysophylla)* trees and 'a'li'i *(Dodonaea viscosa)* shrubs as well as rare kookoolau *(Bidens hawaiiensis)* and naupaka *(Scaevola kilaueae)* plants. Widespread participation from the local community, visiting students, and conservation groups, along with dedicated staff, has been the cornerstone for the success of the project. By the time the project is completed in June 2003, 31 native species, including 15 fire-tolerant species, will be established through a combination of direct seeding and outplanting into 850 plots scattered across the entire burn. Long-term monitoring will determine whether the plants established in the burn will continue to thrive and ultimately create a native plant community that survives future wildfires. ■

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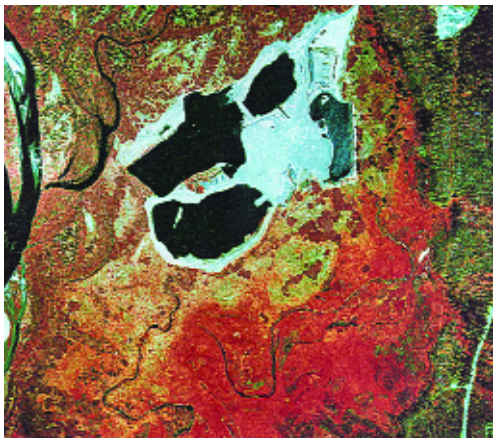
NPS PHOTO

Following the July 2000 Broomsedge Fire at Hawaii Volcanoes National Park, exotic grasses adapted to fire replaced native 'ohi'a woodlands that are fire-sensitive. The park replanted and reseeded the area with fire-tolerant native vegetation (not shown).

Field studies and funding partnerships help restore wetlands at Snake River gravel pit

by Joel Wagner, David Cooper, Michael Martin, and Steve Haynes

FROM THE 1950S THROUGH THE EARLY 1990S, the National Park Service and the Federal Highway Administration extracted thousands of cubic yards of gravel from the Snake River floodplain within the John D. Rockefeller, Jr., Memorial Parkway, Wyoming. The Snake River gravel pit, located approximately 1 mile south of Flagg Ranch, provided gravel for National Park Service road projects and maintenance activities in the surrounding area. Mining ceased in 1992 when the U.S. Army Corps of Engineers determined that the operation violated the Clean Water Act. Closure of the site left more than 60 acres of poorly vegetated waste piles, steep-walled borrow ponds, and sand and gravel stockpiles visible from U.S. Highway 89/287 and the Snake River. The park elected to resolve these regulatory and resource management issues by reclaiming the abandoned mine to a mix of wetlands, oxbow ponds, and uplands modeled after comparable features on the adjacent, undisturbed floodplain.



ENVIRONMENTAL PROTECTION AGENCY

A source of gravel for the John D. Rockefeller, Jr., Memorial Parkway and neighboring Yellowstone and Grand Teton National Parks from the 1950s to 1990s, the Snake River gravel pit created 60 acres of waste piles, steep-walled borrow ponds, and sand and gravel stockpiles.

"Restoration projects of this size and complexity require rigorous data collection and analysis, innovative design, … careful supervision …, and sufficient funding to do the job right."

The Federal Lands Highway Program and the State of Wyoming Abandoned Mine Lands Program contributed a combined $1.3 million, which was sufficient to complete the final design and implement the project. In early 2002, project partners produced final design drawings and specifications for the construction bid documents. An earthmoving contractor was selected in June and construction lasted from mid-July through October 2002. Under the direction of the design team and the on-site construction manager, the contractor reshaped more than 350,000 cubic yards of mine reject material and topsoil into 55 acres of sedge meadows, willow flats, stream channels, oxbow ponds, and upland features.

The NPS Water Resources Division, Colorado State University, and parkway managers from Grand Teton National Park collaborated on the restoration design. These partners based their design on extensive analysis of soil, vegetation, and hydrologic data collected within the mined area and in nearby undisturbed reference areas. Data from 24 shallow wells and six staff gauges provided water-level information that is critical to wetland and riparian ecosystem design. Special factors to be addressed included the complex hydrology of the site, the need to protect existing western boreal toad breeding habitat, and appropriate use of topsoil that had been preserved during the mining process.

A unique aspect of the design process was the use of field experiments to evaluate the potential for willow establishment from natural seed dispersal. Designing the site to promote natural willow establishment saves money because fewer willow cuttings need to be planted and it helps ensure that the site will be a self-sustaining wetland-riparian ecosystem over the long term. Willow seed traps allowed the design team to evaluate distribution and abundance of seed dispersal across the site. Two experimental plots were also created to determine which combination of available soil types (sand, mine reject material, and topsoil) and water-table elevations would optimize willow establishment from seed. The experiment results guided placement of topsoil at critical elevations throughout the site.

In late spring and early summer 2003, contractors will plant more than 580,000 herbaceous wetland plants and 35,000 willow stakes in specified habitat zones. To ensure preservation of local genetic integrity, nursery contractors collected seed and willow cuttings from within 9 miles (15 kilometers) of the project site. With the

"The contractor reshaped … mine reject material and topsoil into … sedge meadows, willow flats, stream channels, oxbow ponds, and upland features."

NPS PHOTO (BOTH)

To restore the area, NPS contractors reshaped reject mine material and topsoil into precise but subtle configurations designed to re-create sedge meadows, willow flats, stream channels, oxbow ponds, and upland features.

A nearby reference site approximates how the area will look after more than 580,000 riparian plants and 35,000 willows are planted in 2003 and given time to mature.

help of the Natural Resources Conservation Service, upland zones will also be revegetated using local seed sources.

Restoration projects of this size and complexity require rigorous data collection and analysis, innovative design, much coordination among cooperators and regulators, tight design specifications, careful supervision of construction and planting phases, and sufficient funding to do the job right. But a final step—monitoring—should not be overlooked. Monitoring of vegetation, hydrology, and soil characteristics will continue for at least three years to document restoration of target wetland habitats and to identify any remedial treatments needed to ensure restoration success. ■

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Wetlands re-created at Fort McHenry

by Betsie Blumberg

The wetland that surrounded Fort McHenry during the War of 1812 is being re-created by the National Park Service, the National Aquarium in Baltimore, and many other partners.

The project has entailed the removal of phragmites, a non-native reed that reduces wetland biodiversity, the introduction of native plant species, the redesign of the area's hydrology, and the monitoring of water quality.

CAN A HUMAN-MADE WETLAND FUNCTION AS a tidal marsh? That is the question scientists are waiting patiently to answer at Fort McHenry National Monument and Historic Shrine, Maryland. The wetlands that surrounded Fort McHenry during the War of 1812 are being re-created with cooperation from the National Aquarium and 30 other public and private organizations. This long-term project in Baltimore is attracting the energies of local and national corporations, nonprofits, government agencies, schools, and the public, who are participating in the cleanup and managing the rehabilitation of wetland vegetation and waters. Their efforts are helping to create a functioning wetland where the original marsh was destroyed by almost three centuries of human assault.

In 1982, after the highway and tunnel for Interstate 95 had been cut through marshland adjacent to Fort McHenry, the State of Maryland was obliged by law to create equal acreage of wetland to replace what was lost. One site that was mitigated, but thereafter neglected, became an eyesore for visitors to the park. In 1997 the park, soon joined by the National Aquarium, began to clean up the 7-acre site and restore the 1812 landscape. At the start of the project, one-third of the area was paved with debris, including everything from old cars to hypodermic needles, and required heavy equipment and hundreds of volunteers to clear. Trash removal is ongoing because tidal flow carries trash in but wetland vegetation and clogged drainageways prevent it from flowing out. Since 1997, project partners have removed 996 tons of debris.

Normally, tides flush a marsh with a regular pulse. However, this has not been happening at this site because the concrete pipes, 3 feet in diameter and designed to lead tidewater past infrastructure to and from the wetland, have become clogged and trap debris. Neither the natural pulse nor the fish that would come with it get through. This situation should be corrected in winter 2002–2003 when cooperating engineers from the USGS, the National Oceanographic and Atmospheric Administration, and aquarium staff reconfigure the hydrology of the site.

Selecting vegetation to introduce was an experiment in itself. The water is brackish and salinity varies, sometimes becoming as high as 50% of seawater. Species successfully established include the salt bush *(Iva fruitescens)*, groundsel tree *(Bacchus halimifolia)*, and smooth cordgrass *(Spartina alternifolia)*. Many wildflowers and emergent aquatic species have spread naturally with good diversity, but all are threatened by the invasive common reed, *Phragmites australis*. To control it the partners have used techniques such as solar blankets (which heat the ground, killing vegetation), herbicides, and mechanical removal, followed by planting of native big cordgrass *(Spartina cynosuroides)*.

Only native flora have been introduced intentionally. When conditions are right, the fauna arrive on their own, most notably birds. One hundred thirty years ago, a physician and ornithologist at the fort made a list of 210 birds he saw in the wetlands. Recently bird-watchers have recorded 195 species there. (A few on the original list have since become extinct, such as the passenger pigeon.)

This new wetland already supports an increasing variety of living things, and the beginning of a peat layer has been detected. But the development of a spongy peat substrate that filters the pulsing tide and that characterizes a salt marsh is a slow process of deposition and accumulation of organic material. Natural wetlands in the Chesapeake Bay are 10,000 years old. Meanwhile, volunteers helping with cleanup, schoolchildren learning about wetlands, local industries complying with recent antipollution regulations, bird-watchers cataloging species, and park visitors who view the marsh from the historic fort are all watching to see what's happening in the new salt marsh. ■

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Trash interferes with the proper function of the wetland and is removed regularly by the partners and volunteers. Left unchecked, the debris clogs pipes linking the wetland and the harbor and stops tidal pulses that carry fish, replenish oxygen, and promote wetland vitality.

Keeping Canada thistle under control at Agate

by Ruthann Knudson

"This … program is a regional model for thistle control on private and public lands."

WHEN NEBRASKA'S AGATE FOSSIL BEDS NATIONAL Monument was authorized in 1965, the federal government owned no land within the new park's boundaries. All of the park's 3,055 acres were originally private ranchlands, most of which had been grazed since the 1880s. After grazing was discontinued in 1974, the Canada thistle *(Cirsium arvense)* began to flourish in the Niobrara River valley.

In 1997, Agate mapped 125 acres of Canada thistle within park boundaries. Following an aggressive management program, only 25 acres of parklands were still infested with thistle by 2002. The thistle control project's success can be attributed to persistent efforts over many years, including integrated pest management, surveying and follow-up monitoring, partnerships, interpretation, and competing for funds to support staff. In 2002 the Midwest Region recognized the success of this program with the nomination of Agate's Maintenance Lead Supervisor, William Matthews, for the Director's Award for Natural Resource Management Through Maintenance for his leadership in this important program.

The program involved a partnership with a regional noxious weed control consortium of federal, state, county, and private landowners and managers. It included the release of stem-mining weevils *(Ceutorhynchus litura)* or gallflies *(Urophora cardui)*, mowing thistle growth just before seed head establishment, and application of herbicide (Telar) after the first hard frost. Over the years, permanent and seasonal park staff completed mowing activities. Park staff or contract workers under supervision of the county's noxious weed program applied herbicides. An intern or seasonal biotechnician funded by the Natural Resource Preservation Program documented the program.

A Geographic Information Systems database available at the park contains information on all relevant areas of biocontrol, mowing, and chemical application. Reports on the results of the 2001 and 2002 programs are also on file at the park. Visitors can learn about the weed control program by reading a site bulletin or visiting a wayside exhibit funded by the Friends of Agate Fossil Beds, Inc.

The park is currently developing an environmental assessment of the use of fire on parklands and an accompanying fire management plan. The relationship between thistle management and fire activities is an important element in the assessment and plan. This successful, well-documented program is a regional model for thistle control on private and public lands and is beginning to be used as such by regional resource managers.

Success in a control program such as Agate's is a function of several factors, including persistence, team performance, and the right weather conditions. Soil moisture is a critical factor in the overwintering success of stem-mining weevils, mowing access, and herbicide applications. The 2002 summer drought inhibited thistle growth in general, but allowed park management to get into all the ordinarily wet meanders along the river valley. The result was an outstanding success. The task ahead is to work with all these factors to keep thistle contained into the future. ■

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Persistence, collaboration, and technical know-how, in addition to favorable weather conditions, contributed to the success of the eradication program. Drought in 2002 inhibited thistle growth generally, but also allowed resource managers to extend their treatment to normally wet meanders of the Niobrara River.

Considered a noxious weed throughout much of the United States, Canada thistle flourished at Agate Fossil Beds National Monument after grazing was discontinued in the park in 1974. An intensive, integrated management program reduced the nonnative species from at least 125 acres in 1997 to just 25 acres in 2002.

AWARD-WINNER PROFILE

Harris recognized for precision and leadership in heavy equipment operation

NPS PHOTO BY RICHARD MAYLE

Paul Harris

Paul Harris is a heavy equipment operator at Redwood National and State Parks, California. Since he began in this position more than a decade ago, Paul has taken his job to the next level. Paul's skill has helped make ecological restoration projects a success by turning the vision of scientists into reality. "I enjoy putting the landscape back to where higher intelligence thinks it needs to be," he says. His accomplishments earned him the 2002 Director's Award for Excellence in Natural Resource Stewardship Through Maintenance.

Presenting the award last August, Mike Soukup, NPS Associate Director for Natural Resource Stewardship and Science, introduced Paul as "the surgeon general of the National Park Service maintenance force." Paul is known for his superior ability to operate equipment and direct crews in environmentally sensitive areas. For Paul the skill comes naturally: "I'm just accomplishing the tasks that need to be done; I try to improve the roads and parks without harming anything important." Paul manipulates massive machinery to perform delicate and precise tasks. His talent was put to the test in returning 3 acres of paved sawmill yard to the original stream and wetland configuration established by hydrologists. Known as the Elk Meadow Day Use Area, it is now the focal point for visitor observation of Roosevelt elk, great blue heron, kingfisher, and green-winged teal, among other wildlife. For Paul to complete this project, he needed to operate an excavator on slopes of 60%.

Paul's capabilities have earned him great respect and a reputation that has spread throughout the region. He is a leader in his field and has managed to "operate" on steep terrain without a single accident. His goal every day is to keep himself and his crew safe. "We all want to go home at night; that's what matters the most to me." Paul's ability has given him the opportunity to work on projects at Santa Monica Mountains National Recreation Area, also in California, and Puukohola Heiau National Historic Site, Hawaii. At Santa Monica Mountains he removed 2 miles of road that was in the middle of an ecologically sensitive riparian canyon. At Puukohola Heiau, Paul was instrumental in removing almost 2,000 feet of road through archeological and burial sites. This additional work sometimes kept him away from his family for up to a month at a time, but he never complained; his dedication to the task at hand was always a priority.

Paul works routinely with wildlife biologists, geologists, hydrologists, and archeologists who make up the resource staff at Redwood. In helping to formulate strategies for the restoration projects, Paul is a true leader and is always willing to listen. He is a team player who allows his ability to speak for itself. ■

NPS PHOTOS (BOTH)

Paul Harris's precision earthmoving skills (before, top) resulted in the 2001 re-creation of Elk Meadow (after, bottom), a wetland at Redwood National Park, California, that had been used for several decades as a storage area for logs awaiting processing at a sawmill.

Restoration accomplishments at Civil War earthworks

by Terri Hogan

Vegetation monitoring completed in 2002 at Stones River National Battlefield, Tennessee, confirms the successful establishment of native grasses on the earthworks of Fortress Rosecrans. Constructed in 1863, Fortress Rosecrans was the largest enclosed earthen fortification built during the Civil War. When the National Park Service acquired 26 acres of the site in 1993, it was engulfed in exotic plants. To preserve and interpret this historic structure and cultural landscape, park staff implemented a restoration plan.

The plan involved cutting woody species, treating invasive plants with herbicides, and planting warm-season native grasses. The native grasses were selected to revegetate the earthworks because they have extensive root systems that stabilize the structures. The native species are also adapted to the hot, often dry conditions and low-nutrient soils of middle Tennessee. Once established, these plants require less maintenance, which reduces the impact of human activity on the structures. The Cultural Resources Stewardship Division of the Southeast Region is compiling proto-

Water diversion structure aids fish and agriculture

by Kenneth Hyde

In 2002 a new water diversion structure and fish screen in John Day Fossil Beds National Monument, Oregon, restored fish travel in Rock Creek and reduced withdrawals needed to irrigate historical hayfields. Since 1899, irrigation water has been diverted from the creek to two hayfields in the monument. Limited water reached the fields because of seepage while traveling 2 miles in an unlined ditch. Stacked rocks diverted much of the creek's water during summer and blocked passage upstream for most fish species. The diversion hampered colder-water fish, such as the threatened summer steelhead *(Oncorhynchus mykiss)*, limiting their ability to reach cooler water during hot summers.

In 2002 a partnership with the Grant Soil and Water Conservation District and the Oregon Department of Fish and Wildlife, and funding from the NPS Recreational Fee Demonstration Program, allowed construction of a technologically advanced diversion structure and fish screen to encourage fish passage. The new diversion employs a channel that allows all fish species to pass in summer. The diversion stanchions lie flat in winter, facilitating natural stream-related processes. The fish screen returns fish entering the irrigation ditch back to Rock Creek within 50 yards of the diversion, so they are not entrapped in the ditch or fields. In 2003 the park will install pipe in the remaining unlined segments of the ditch, improving water delivery. ■

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NPS PHOTO BY KEN HYDE

cols and lessons learned from the restoration process into an earthworks management manual.

Park staff monitored plots in 2000, 2001, and 2002. Analysis of these data in 2002 reveals that native grass cover has increased significantly. Native forbs, invasive species, and vines also appear to be increasing; however, these trends are not statistically significant. These findings will be used to adjust management practices. Today, as a result of science-based restoration efforts by cultural and natural resource managers, the historic structures are stabilized, native species have regained their place in the landscape, and exotic species are managed. ■

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NPS PHOTO BY SCARLETT DAVIS

NPS PHOTO

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Helicopter tree removal improves butterfly habitat

by Daphne Hatch

During three days of near-perfect weather in late February 2002, the collaborative efforts of more than 100 people culminated in the helicopter removal of invasive Monterey pine trees *(Pinus radiata)* from 10.5 acres within Golden Gate National Recreation Area (California). The trees were removed to improve habitat for the mission blue butterfly *(Icaricia icarioides missionensis)*, a species listed as federally endangered. The butterflies feed on lupines *(Lupinus albifrons)*, which the Monterey pine trees deprive of sunshine and water. When the lupines die, so do the butterflies.

A high public profile accompanied the project because the restoration area is within view of the Golden Gate Bridge. Success hinged on a number of factors, including timing and clear communication with the public. Timing the project was complicated by the bird nesting season (March to August), the flight season of the butterfly (March to July), summer fog, and the raptor migration at Hawk Hill (August to December), the project's location. The trees to be removed were on steep slopes in the midst of butterfly habitat, with the roots of some trees damaging coastal defense fortifications. Additionally, the project involved road closures and detours that affected the public.

After careful analysis, park staff chose tree removal by helicopter as the most suitable method to minimize ground disturbance on steep slopes in sensitive habitat. Winter presented the best opportunity for removing the trees, avoiding the fog and minimizing conflicts with hawks and butterflies. An outreach campaign for park visitors and the media resulted in strong public support and cooperation. Not only did the project restore endangered species habitat, but it also protected coastal defense fortifications, enhanced scenic vistas, and improved visibility of the hawk migration. The Recreational Fee Demonstration Program provided funding for the project. ■

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Creating pollinator-friendly plant communities in an urban park

by Gopaul Noojibail

Pollination of flowering plants by animals provides a service to society that is both biologically significant and economically important. Unfortunately, native pollinators such as bees, butterflies, and moths have been on the decline in recent years, and some experts believe that these declines are reaching crisis levels. In 2002, National Capital Parks–Central initiated an experimental project to increase native insect pollinator populations in Washington, D.C., and the National Capital Region. The effort sought to restore native plant communities in East Potomac Golf Course (photo, shown three months after seeding), located on national parkland in downtown Washington, D.C.

NPS PHOTO BY GOPAUL NOOJIBAIL

East Potomac Golf Course is an important natural oasis in a predominantly urban landscape that can serve as an example of how habitat renewal can be achieved within urban areas. Once restored, roughs and out-of-play areas within the golf course will function as refuges for plants and their insect pollinators, increasing pollinator movement throughout the region. Native plant communities also offer the benefit of low, long-term costs once established. Information on the effectiveness of restoring pollinator habitat generated by the project will be used to make decisions about the placement of additional sites within the region.

The golf course is host to more than 115,000 visitors a year; this project will significantly increase its interpretive and educational significance, giving park staff the opportunity to communicate the value of golf courses to both urban and regional ecosystems. ■

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Fire Ecology Program gets organized

by Greg Eckert

As a result of congressional funding of the National Fire Plan, the NPS Fire Management Program has hired more than 30 fire ecologists and stationed them at national and regional offices and in national parks. Most of these staff are qualified as professional scientific ecologists, having met the eligibility requirements for a series 408 ecologist; a few are working toward these qualifications through university graduate degree programs or continuing education. Impetus for the Fire Ecology Program developed from an increasing need for technical expertise in several areas:

- Collection, analysis, and interpretation of fire effects data
- Adaptive management
- Liaison between fire and resource management at park, regional, and national levels
- Collaboration with other government agencies and nongovernmental organizations
- Various levels of park management planning (general, resource, fire, and prescribed fire)
- Landscape-level assessments

The Fire Management and Natural Resource Program Centers called for the new emphasis on integrating natural resource and fire management. The Fire Ecology Program will work to provide the best science for managers addressing risks of how and where to apply fire on the landscape or to withhold it. In addition, it is working with the Natural Resource Program Center (NRPC) to design a workshop for developing conceptual ecological models, identifying desired future park conditions, assessing risks related to fire, and interdisciplinary planning. A pilot version of this course will be held in spring 2003.

The Fire Ecology Program has historically revolved around monitoring long-term ecological trends associated with prescribed fire in a limited number of national parks. The recent staffing increases will enable the program to provide services to all regions and many more park units. In addition, the scope of the program will grow to include monitoring fire effects for both prescribed and wildland fire and data storage and analysis. New fire effects monitoring software is being developed to facilitate broader analysis, including spatial analysis. The new application will support monitoring techniques and protocols associated with fire and resource management. All fire monitoring data will be archived in regional and national databases and made available over the Internet.

NPS PHOTO (BOTH)

These photographs compare a vegetation plot at Everglades National Park, Florida, that has experienced normal fire frequency and intensity (top) with one that has not had fire for 30 years. With its unnaturally thick vegetation, the fire-exclusion site would require mechanical and other treatments before fire could be restored as a natural process. The Fire Ecology Program will provide support for fire management and restoration in park landscapes.

The Fire Management Program Center is hiring a fire ecologist to be located at the NRPC office in Fort Collins, Colorado. This position will manage the national fire effects database and the new software application and serve as a liaison between the Fire Management Program and the Natural Resource Program Center. ■

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